Kameleon Software Suite

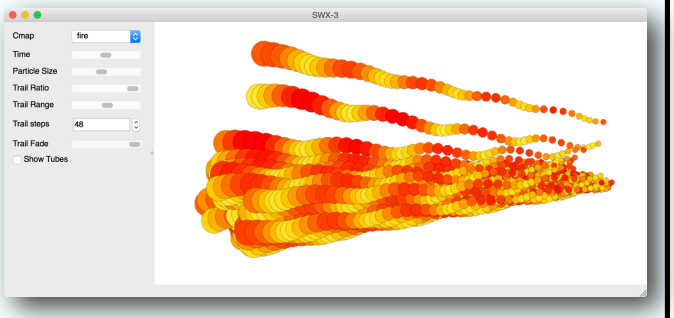
Kameleon is a suite of cross-platform tools that address the challenges in analysis, visualization, and dissemination of space weather model data hosted by the CCMC. We are continuing to serve community needs through **Standardization**, **Accessibility**, and through innovations that enable science **Discovery**.

Standardization - Kameleon converters take raw output from CCMC-hosted models and converts to platform-independent CDF or HDF5 format, including domain-dependant metadata and provenance information. We are working to add support for community standards, such as SPASE and IMPEx.

Accessibility - kameleon interpolators provide model results at user-defined positions. APIs exist for C++, C, Fortran, Java, and Python. We are working to incorporate satellite trajectories (SPICE), improve derived variables and unit conversions, as well as support coordinate transformations.

Discovery - We are developing new high-level online and offline analysis and visualization tools to enable rapid exploration of model results with minimal coding experience.

Space Weather Explorer (SWX-3)



SWX-3 incorporates novel techniques we're developing to fascilitate rapid model reduction and science discovery. SWX-3 uses the Kameleon access and interpolation routines for real-time data analysis and GPU-accelerated visualization. The example above shows particle trails obtained from AMPS. The gui and analysis tools are all built on python libraries, which are cross-platform. Results produced from SWX-3 will be exportable to VTK and other common vis formats.

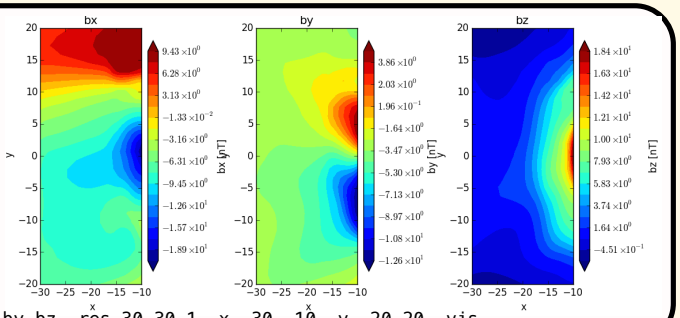
- Lead Developer: Asher Pembroke
- Git Repository https://github.com/ccmc/ccmc-software
- Kameleon Home Page http://ccmc.gsfc.nasa.gov/downloads/kameleon_instructions/html/README.html

Command Line Interfaces

grid.py - a simple python command-line-interface into model results. Users can query metadata, define 3D grids for interpolating results, and quickly visualize multiple slices of data via matplotlib.

Example usage producing the plots on the right:

```
$ python grid.py kameleon-converted-swmf.cdf -vars bx by bz -res 30 30 1 -x -30 -10 -y -20 20 -vis
```



Kameleon Live is an online interface into the CCMC runs-on-request database that allows users to create tailored Studies built around specific modeled events, through interactive, collaborative exploration of model results in the browser. It combines permissioned wiki-style editing with robust, dynamic Bokeh plots, such as those shown on the right: here, a user specifies multiple variables and cut plane parameters, and the plot is dynamically loaded into the view; as the user pan/zooms on one variable, the other plots are updated in real-time. The plots can then be embedded in the user's Study page, to which the user may invite others to view and contribute.